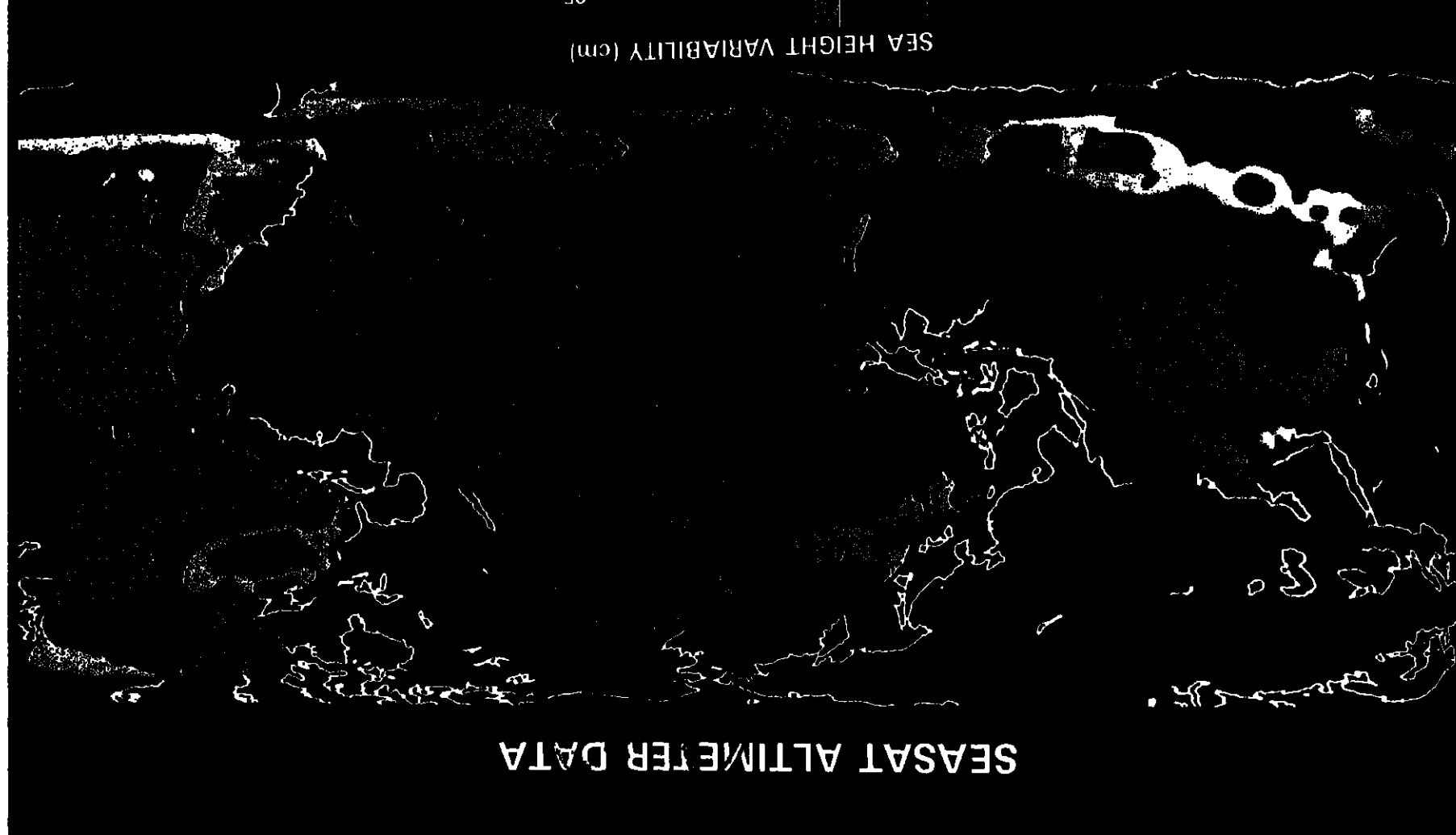


SEA HEIGHT VARIABILITY (cm)



Vol. 65 No. 10 March 6, 1984  
Transactions, American Geophysical Union

**EOS**

Eos, Transactions, American Geophysical Union

Vol. 65, No. 10, Pages 81-96

March 6

# Volcanology

**8599 Volcanology**  
CALDERAS AND ASH-FLOW TUFFS OF THE MOCOLLO MOUNTAINS, NEW MEXICO  
J. C. Garcia (U.S. Geological Survey, Box 2556, Federal Center, MS 905, Denver, Colorado 80225), R. T. Marvin, C. V. Weaver, R. S. Wilson  
The Mogollon Mountains are a major volcanic source area in the southwestern part of the Mogollon-Datil volcanic field, where about 2000 m of middle-Tertiary volcanic rocks are exposed. The volcanic sequence includes eight major (>100 km<sup>2</sup>) ash-flow tuff units, which are believed to represent a caldera-related, compositionally zoned ash-flow tuff series. The tuff units, which range in age from 1.5 to 2.5 Ma, are separated by basaltic and andesitic flows. The sequence is interpreted as a series of caldera-forming eruptions, beginning about 2.5 Ma, of which the Mogollon caldera is the youngest. The sequence is interpreted as a series of caldera-forming eruptions, beginning about 2.5 Ma, of which the Mogollon caldera is the youngest. The sequence is interpreted as a series of caldera-forming eruptions, beginning about 2.5 Ma, of which the Mogollon caldera is the youngest.

**8600 Volcanology**  
CALDERAS OF THE SIERRA MADRE OCCIDENTAL VOLCANIC FIELD, WESTERN MEXICO  
Eric R. Skason (Division of Earth and Physical Sciences, University of Texas at San Antonio, San Antonio, Texas 78249), Fred B. Sisson  
Approximately 250,000 km<sup>2</sup> of western Mexico is covered by a volcanic sequence that has an average thickness of 1 km and is mostly ash-flow tuff. Although only a few have been located or documented, examples are in the 30 Ma-old Chaparral caldera complex near Durango City. Other possible calderas are located in the Sierra Madre Occidental volcanic field. The Chaparral caldera is a large, 135 km in diameter, caldera. The Chaparral caldera is a large, 135 km in diameter, caldera. The Chaparral caldera is a large, 135 km in diameter, caldera.

**American Geophysical Union**

**NEW RELEASES**

**Geodynamics Series Volume 11**  
**Geodynamics of the Western Pacific-Indonesian Region**  
(1983)  
edited by T. W. C. Hilde and S. Uyeda  
**\$38**

**Geophysical Monograph Series Volume 28**  
**Magnetospheric Currents**  
(1984)  
edited by T. Potemra  
**\$33**

**AGU Special Publication**  
**A Streetcar to Subduction**  
and Other Plate Tectonics Trips by Public Transport in San Francisco  
(revised 1984)  
by C. Wahrhaftig  
**\$7.50**

**Writer Resources Monograph Series Volume 9**  
**Groundwater Hydrology**  
(1984)  
edited by J. S. Rosenzweig and G. D. Bennett  
**\$18**

**Tectonic Map of the Rio Grande Rift and Southeastern Colorado Plateau, New Mexico, and Arizona**  
(1983)  
by W. B. Balgord, Y. Barlov and A. Kron  
**\$15**

**BOOK AND MAP SPECIAL**  
above map plus  
**Rio Grande Rift: Tectonics and Magmatism**  
(1979)  
edited by R. E. Fleck  
**special combination price \$35**

AGU members receive a 30% discount

Write: American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC 20009

Call: 800-424-2468 (200) 462-8000 (in DC area or outside contiguous USA)

Write: Western Union, 2000 Florida Avenue, N.W., Washington, DC 20009

## News

### Ocean Drilling Ship Chosen

The *SedcoBP 471*, owned jointly by Sedco, Inc., of Dallas, Tex., and British Petroleum, has been selected as the drill ship for the Ocean Drilling Program (ODP). The contract, with a specified initial term of 4 years with 10 1-year options after that, is expected to be signed by mid March by Texas A&M University, the ODP science operator, and Sedco, Inc. Texas A&M will develop the design for scientific and laboratory spaces aboard the *SedcoBP 471* and will oversee the ship conversion. Testing and shakedown of the ship is scheduled for the coming autumn; the first scientific cruise is scheduled for next January.

One year ago, the commercial drilling market suggested, opening up the option for leasing a commercial drill ship (Eos, February 22, 1983, p. 73). Previously, the ship of choice had been the *Glomar Explorer*; rehabilitating the former CIA salvage ship would have been extremely expensive, however.

Built in Halifax, Nova Scotia, in 1978, the *SedcoBP* ship will provide berths for a crew of 55 and for a scientific crew of 50. By comparison, the *Glomar Challenger* could accommodate only 45 crew members and 29 scientists (see Table 1). Moreover, the new drill ship will provide roughly 2.5 times the laboratory space that the *Challenger* had afforded scientists. Although the new drill ship has the capacity for deploying a riser system (with blow-out prevention) in 1,800 m of water, the capability is not expected to be used during the first few years of operation. The *SedcoBP* ship has better weather limits than the *Challenger*, Philip Rabinowitz, ODP project director and principal scientist, told Eos.

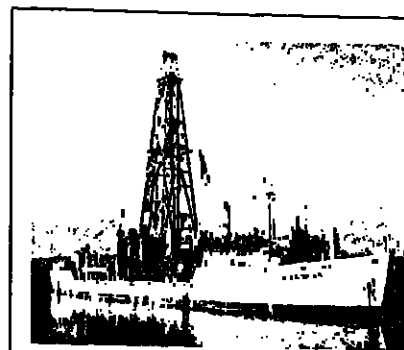
Current plans call for early legs of the drilling program to include studies of the tectonics of the eastern Gulf of Mexico; the carbonate sedimentation in the Bahamas; a study of the opening of the Labrador Sea and its history of glaciation; early rifting processes in the Norwegian Sea; chronology of sediments and the distribution of Sahara dust off northwest Africa; the development of back-arc basins; tectonics of the Hellenic and the Tyrrhenian Sea; and paleoenvironmental studies of the ancient Tethyan Sea. Each leg will last approximately 2 months.

ODP will incorporate a new drilling capability, have-rack spud-in, that will allow scientists to study active processes of crustal accretion in areas of little or no sediment accumulation.

The network overseeing ODP involves many: ODP is supported by the National Science Foundation through its Division of Ocean Sciences. The Joint Oceanographic Institutions, Inc. (JOI), a consortium of 10 major oceanographic institutions, is ODP program manager. Scientific direction is provided by the Joint Oceanographic Institutions for Deep Earth Sampling (JODIES), an international organization of earth scientists from nations participating in ODP. Drill ship operations will be managed from ODP science operator headquarters at Texas A&M University, where cores from the Pacific and Indian Oceans will be kept. (Construction of a new \$5 million building at Texas A&M, to house the core repository and the drilling office, is expected to begin later this year and to be completed 2 years later.) Lamont-Doherty Geological Observatory of Columbia University will be a repository for cores from the Atlantic and Antarctic oceans and from the Mediterranean and Caribbean seas. Lamont-Doherty also will plan for and manage wire-line logging operations.

In addition to U.S. support, several nations have either joined as full participants or as candidate members. A memorandum of understanding for participation as a full member in ODP was signed in ceremonies on March 5 by the Federal Republic of Germany. The FRG is the first country to join ODP as a regular member. The European Science Foundation (ESF), a consortium that includes Italy, the Netherlands, Sweden, and Switzerland, signed on as a candidate member at the same ceremony last week. ESF joins Canada and the United Kingdom as candidate members; each will participate in the planning of drilling activities.

William J. Merrell, Jr., associate dean of the College of Geosciences at Texas A&M, is ODP principal investigator.—HTR



The *SedcoBP 471*, selected as the new drill ship for the Ocean Drilling Program, is expected to be ready for its first scientific cruise in January 1985.

The disk surrounding R Mon is 4 times larger than the one around HL Tau, but is otherwise similar. Both are most likely composed of silicate dust, with the individual particles only a few thousandths of a millimeter across. Both stars are also very young—a mere 100,000 years old in the case of HL Tau, much younger than either Vega or Fomalhaut.

These observations, when plugged into theories of planetary formation, suggest that the swarms of material surrounding HL Tau and R Mon have not yet coalesced into the planets that eventually become planets. So young is the HL Tau system, in fact, that radiation pressure from the star would only just have begun to sweep these small dust particles away from the center of the disk. From their observations, the astronomers also infer the presence of hydrogen and helium gas around the two stars, comparable in total mass to that of our own giant gas planets. And even though the total amount of dust directly observed by the team only adds up to one earth mass in the case of HL Tau and five earth masses for R Mon, Beckwith believes that this is a conservative estimate of the total amount of material in the systems, because "we're probably only seeing the edge of the shell."

All of this adds up to the newest tentative entries in what may eventually become a catalog of other solar systems in the galaxy in different stages of evolution from our own.—HTR

### Arctic Hurricanes

The devastating winter storms that sweep across the Arctic, endangering offshore oil rigs, shipping, and fishing operations in their paths, are the subject of current study by a team of weather researchers from the National Oceanic and Atmospheric Administration (NOAA). As part of the study, U.S. scientists and those from several other countries also will attempt to estimate how much carbon dioxide is transferred from the atmosphere into the North Atlantic's deep waters during winter storms.

A typical polar low, like a hurricane, has a spiral cloud pattern and winds exceeding 120 km per hour, said Melvin Shapiro, senior meteorologist on the polar-low study. The storms are smaller than most hurricanes, however, and rarely have a diameter greater than 320 km. Some, but not all, develop an "eye" like a hurricane. Polar lows, only recently documented from polar orbiting satellite imagery, appear to form primarily from October to April, but peak in February.

"These arctic hurricanes can develop very rapidly," Shapiro said. In a matter of hours the hurricanes can produce winds as high as 160 km per hour, causing "very high sea states that are extremely dangerous to shipping in the area, as well as to any offshore oil activities," he added.

The CO<sub>2</sub> investigation may give scientists additional information on possible global warming from increased CO<sub>2</sub>; the ocean is believed to be a sink for nearly half of the CO<sub>2</sub> injected into the atmosphere by the burning of fossil fuels. However, little is known about the uptake of CO<sub>2</sub> in regions of the North Atlantic, according to NOAA's Richard Gammon.

Researchers also will study Icelandic lows, which play a major role in extracting heat from the Gulf Stream. In addition, the scientists will examine electrical properties, conduct surface profiling of the Greenland ice cap, perform meteorological and oceanographic studies along the polar ice edge, to investigate the ice edge's possible link to the outbreak of cold air masses.

### New Solar Systems?

A team of astronomers from UCLA, Cornell University, and the University of Hawaii have discovered what may be two new planetary systems orbiting around young stars in the constellations Taurus and Monoceros. The team's ground-based infrared observations of HL Tau and R Mon reveal features similar to those seen around Vega and Fomalhaut last year by NASA's Infrared Astronomical Satellite (IRAS)—disks of very fine dust particles extending outward from a central star. If current theories about solar system formation are correct, then these disks most likely represent an early evolutionary step in the formation of planets.

ery to counter the effects of atmospheric distortion, Steven Beckwith of Cornell, Benjamin Zuckerman of UCLA, Melvin Dyck of the University of Hawaii, and Cornell graduate student Michael Skrutskie were able to make the observations using telescopes on Mauna Kea in Hawaii and Kitt Peak in Arizona. What they saw in both cases was short-wavelength infrared starlight being scattered by dust particles surrounding the star. In the case of HL Tau, the dusty "cloud" appears to extend out about 160 Astronomical Units from the star (4 times as wide as our solar system) in the east-west direction, but only half that far in the north-south direction. The explanation, according to Beckwith, is that "we're looking at a tilted disk rather than an oblate spheroid." The cloud, in other words, is neither exactly edge-on nor face-on as seen from earth.

The disk surrounding R Mon is 4 times larger than the one around HL Tau, but is otherwise similar. Both are most likely composed of silicate dust, with the individual particles only a few thousandths of a millimeter across. Both stars are also very young—a mere 100,000 years old in the case of HL Tau, much younger than either Vega or Fomalhaut.

These observations, when plugged into theories of planetary formation, suggest that the swarms of material surrounding HL Tau and R Mon have not yet coalesced into the planets that eventually become planets. So young is the HL Tau system, in fact, that radiation pressure from the star would only just have begun to sweep these small dust particles away from the center of the disk. From their observations, the astronomers also infer the presence of hydrogen and helium gas around the two stars, comparable in total mass to that of our own giant gas planets. And even though the total amount of dust directly observed by the team only adds up to one earth mass in the case of HL Tau and five earth masses for R Mon, Beckwith believes that this is a conservative estimate of the total amount of material in the systems, because "we're probably only seeing the edge of the shell."

All of this adds up to the newest tentative entries in what may eventually become a catalog of other solar systems in the galaxy in different stages of evolution from our own.—HTR

### Changes in Earth Programs at NSF

Three programs within the Earth Sciences Division of the National Science Foundation (NSF) have changed names to more accurately reflect the programs supported by them, according to James E. Hays, division director. In addition, the division has two new programs: continental lithosphere and instrumentation and facilities.

The seismology and deep earth structure program is now the seismology program; the environmental geosciences program will now be called the surficial processes program. The scope of these two programs has not been changed.

Volcanology and mantle geochemistry, formerly the mantle geochemistry program, has been expanded to include all aspects of volcanological research. Previously, volcanology proposals were considered in various programs within the division.

The continental lithosphere program, proposed as a separate program in the fiscal 1985 budget (Eos, February 14, 1984, p. 49), will support multidisciplinary, multi-institutional research projects, including COCORP (Consortium for Continental Reflection Profiling), a global digital seismic array; seismic studies of continental crust; and continental drilling. Within the earth sciences community there is a growing interest in developing such larger cooperative programs, Hays told Eos. Recent reports by the National Research Council's Board on Earth Sciences and by the earth sciences briefing panel within the National Academy of Sciences' Committee on Science, Engineering, and Public Policy confirm this consensus (Eos, December 20, 1983, p. 185). Hays added.

The establishment of a new program called instrumentation and facilities formalizes efforts in the past 2 years to direct more funding to instrumentation, Hays said. The program will support development of new and improved instruments and the purchase of equipment such as electron microscopes, magnetometers, X-ray diffractometers, computers, and mass spectrometers.

Annual target dates for proposal submissions are announced in the *NSF Bulletin*. Compliance with the target dates may reduce the interval between submission to NSF and the making of funding decisions. However, proposals will be accepted at any time. Instructions for preparation of proposals are included in "Grants for Scientific and Engineering Research" (NSF 83-57). Project descriptions should not exceed 15 single-spaced typewritten pages (the equivalent of 30 double-spaced pages is acceptable).—BTR

### Young Faculty Awards

Of the 200 science and engineering faculty members who have been selected to receive the first Presidential Young Investigator Awards, roughly one dozen are researchers in geophysics or geophysics-related fields. The awards, which are for up to \$100,000 per year for 5 years (a combination of federal and matching private funds) for each recipient, are intended to help universities attract and retain outstanding young Ph.D.s who might otherwise pursue careers outside academia.

More than half of the 200 awards for fiscal 1985 went to engineers. The selection of the 200 was made from 1549 nominations from 232 Ph.D.-granting institutions. The new investigators will conduct research at 74 universities in 35 states. The program is administered by the National Science Foundation (NSF).

President Reagan has proposed that 400 awards be given in fiscal 1985; 200 to continue support for those just selected and 200 to support a new group of recipients.

The annual base grant from NSF is \$25,000. In addition, NSF will provide up to \$7,000 per year to match contributions from industrial sources. Individual universities are responsible for raising the nonfederal funds. Among the award recipients are:

- Robert W. Clayton, California Institute of Technology; global seismology.
- A. Gordon Emslie, University of Alabama, Huntsville; solar astronomy.
- Michael H. Engel, University of Oklahoma, Norman; organic geochemistry.
- Raymond Jeanloz, University of California, Berkeley; high pressure geophysics.
- Joseph L. Kirschvink, California Institute of Technology; paleomagnetism and geobiology.
- Roman Krzywicki, University of Virginia; water resources engineering.
- Daniel R. Lamb, Dartmouth College; water resources engineering.
- Larry J. Rull, University of Michigan, Ann Arbor; earthquake seismology.
- Jerry R. Stedinger, Cornell University; hydrology and water resources.
- Diane E. Stevens, Colorado State University; dynamics of earth's atmosphere.
- E. Bruce Watson, Rensselaer Polytechnic Institute; experimental geochemistry.—HTR

### Geophysicists

In Memoriam

**Hugh Odishaw**, 67, died on March 4. An AGU Fellow, he joined AGU in 1954 as a member of the Solar-Planetary Relationships section. The former executive director of the U.S. National Committee for the International Geophysical Year was a professor of geophysics at the University of Arizona in Tucson.

### Recent Ph.D.'s

Eos periodically lists information on recently accepted doctoral dissertations in the disciplines of geophysics. Faculty members are invited to submit the following information, on institution letterhead, above the signature of the faculty advisor or department chairman:

- (1) dissertation title.
- (2) author's name.
- (3) name of the degree-granting department and institution.
- (4) faculty advisor.
- (5) month and year degree was awarded.

If possible include the current address and telephone number of the degree recipient (this information will not be published).

Dissertations with order numbers, and many of the others listed, are available from University Microfilms International, Dissertation Copies, P.O. Box 1761, Ann Arbor, MI 48106.

**Effect of Subvolcanic Structure on the Movement of Two Non-Volatile Organic Pollutants (Nitrobenzene, Trichlorobenzene).** Lawrence J. Henderson, Oklahoma State Univ., 1983 (GAX83-25810).  
**Evaluation of Emergency Water Supplies as Drought Management Alternatives.** Benedek Driegelskewitz, Southern Illinois Univ., Carbondale, 1983 (GAX83-26522).  
**Flow Strengths of Quartz Aggregates, Carbon, and Oxygen Diffusion in Calcite.** Andreas K. Krause, Brown Univ., 1983 (GAX83-25907).  
**Geochronological Evolution of the Inverclyde Zone.** North Peak Granite, Utah, Peter I. Nabelek, State Univ. of New York, Stony Brook, 1983 (GAX83-25928).  
**Geochemistry of Okefenokee Sediments.** Der-Duen Sheu, Texas A&M Univ., 1983 (GAX83-25710).  
**Groundwater Flow in the Crystalline Rocks of the Acacia Plains of Ghana, West Africa.** Kotana, Andrew, Princeton Univ., 1983 (GAX83-25878).  
**Inversion of Body-Wave Seismograms for Upper Mantle Structure.** Jeffrey W. Givens, California

News (cont. on p. 98)



## News (cont. from p. 97)

Institute of Technology, 1981 (GAX83-25710).  
*Investigation of Turbulent Scatter from the Mesosphere as Observed by Coherent Scatter Radar*, Kenneth P. Gibbs, Univ. of Illinois, Urbana-Champaign, 1983 (GAX83-24557).  
*Mathematical Analysis of the Dynamics of a High-Grade Metamorphic Gneiss*, Thomas D. Gaskin, Univ. of Kentucky, 1983 (GAX83-22498).  
*Metamorphism and Copper Mineralization of the Portage Lake Lava Series, Northern Michigan*, Alexander Livinat, Univ. of Michigan, 1983 (GAX83-24532).  
*Microgravity and the Theory, Measurement and Application of Gravity Gradients*, Dwayne K. Butler, Texas A&M Univ., 1983 (GAX83-23451).  
*Paleomagnetic Studies in the Northern Appalachians and Their Implications for the Paleozoic History of the Orogen*, Danni J. Sparrow, Dept. of Geological Sciences, Columbia Univ., November 1983.  
*Petroleum and Geochemistry of Okmok and Wrangell Volcanoes, Alaska*, John Christopher, Univ. of California, Santa Cruz, 1983 (GAX83-23785).  
*Photoacoustic Properties of Iron in Natural Waters*, T. David Waite, Dept. of Civil Engineering, MIT, (February 1984).

*Physiological-Climatological Model to Predict Ticks as Risk Vectors*, Vira Thomsom, Texas A&M Univ., 1983 (GAX83-23709).  
*Relationships of Rock Cleavage Fabrics to Intrusion and Accumulated Strain in a Portion of the Blue Ridge, Virginia*, James B. Tapp, Univ. of Oklahoma, 1983 (GAX83-24805).  
*Response of a Small Lake to Atmospheric Forcing During Fall Cooling*, Paul T. Stull, Univ. of California, Davis, 1983 (GAX83-26081).  
*Risk Assessment for Water Quality Management*, Heather D. Wicks, Univ. of Michigan, 1983 (GAX83-24309).  
*Statistical-Dynamical Study of the Large-Scale Interannual Variability of the Northern Hemisphere Winter Circulation*, Siegfried D. Schubert, Univ. of Wisconsin-Madison, 1983 (GAX83-23539).  
*Structural and Geochemical Evolution of a Mineralized Volcanic Vent at Cerro de Pasco, Peru*, Ralph D. Rogers, Univ. of Arizona, 1983 (GAX83-23747).  
*Structure of Turbulent Entraining Flow in an Anular Well with a Rotating Screen*, Soon-Chang Yoon, Oregon State Univ., 1983 (GAX83-20437).  
*Studies on the Generation, Dispersal and Deposition of Tephra in the Marine and Terrestrial Environment*, Steven N. Carey, Univ. of Rhode Island, 1983 (GAX83-20479).

*Theoretical and Empirical Travertine Heat Flow Studies (Mexico)*, John P. Ziegler, Southern Methodist Univ., 1983 (GAX83-20672).  
*Theoretical Studies of Mesoscale Eddies and Their Influence on Acoustic Transmission Through the Ocean*, Samuel Iuzik, Reussel, Politechnic Institute, 1983 (GAX83-21195).  
*Thermal Tides in the Atmosphere of Venus*, Judith B. Pechmann, California Institute of Technology, 1983 (GAX83-21031).  
*Thorium-230-Uranium-238 Disequilibrium Systematics in Young Volcanic Rocks (Hawaii, California, Price Edward Island)*, Sally Newman, Univ. of California, San Diego, 1983 (GAX83-19134).  
*Three Dimensional Ray-Tracing and Ray-Inversion in Layered Media (1), Inverse Seismology and Curved Ray Tomography With Applications to Seismology (2)*, John A. Fawcett, California Institute of Technology, 1983 (GAX83-23731).  
*Vacuum Ultraviolet Photorefractography of Water and Nitrogen Dioxide: Laboratory Studies and Atmospheric Applications*, Jan-Bai Nee, Univ. of Michigan, 1983 (GAX83-24233).  
*Wave Propagation in Porous Rock and Models for Crustal Structure*, Terry D. Jones, Stanford Univ., 1983 (GAX83-20729).

## Books

## Mineral Deposits and Global Tectonic Settings

A. H. G. Mitchell and M. S. Garson, Academic, New York, xvii + 408 pp., 1981, \$48.50.

Reviewed by Robin Brett

"The earth does not conceal metals in her depths because she does not wish that men should dig them out, but because provident and vigorous Nature has appointed for each thing its place." Agricola (*De Re Metallica*, 1556, translated by H. C. Hoover and L. H. Hoover, London, Mining Magazine, 1912).

This book aims to show how ore deposits are related to the concept of plate tectonics. It succeeds. Not too long ago, opaque minerals in a thin section were called "ore" by petrologists and then ignored, and ore deposits were freaks of nature which tended to be where you found them. Today, "ore" and ore deposits have become part of mainstream geologic studies—opaque minerals can reveal much about the evolution of a rock, and mineral deposits can reveal tectonic settings.

The main value of this book to most AGU members is that it shows how ore deposits can reveal tectonic setting, ambiguously in many cases, to be sure, but a pattern is emerging. Mitchell and Garson do not stress the flip side, the application of plate tectonics to exploration, although applications are apparent, and a short chapter is devoted to this aspect.

The authors emphasize that ores are rocks that are part of a stratigraphic or igneous sequence and that, just as andesites are anticipated in some tectonic settings and not in others, so are certain types of ore deposits. Mitchell and Garson, whose publications indicate that they are equally at home in the areas of tectonics and mineral deposits, discuss the plan of the book in their preface:

In the first chapter we discuss briefly why tectonic settings are a major control on the nature of the minerals deposited in economic concentrations, and review the pre-plate concepts of the relationship of mineralization to geosynclinal settings. We then introduce the plate tectonic hypothesis, and indicate the major developments in ideas on the relationship of mineral deposition to plate processes. The next six chapters, comprising the bulk of the book, are

concerned with the brief description of each of the major types of tectonic settings recognizable today followed by an account of the main kinds of economic deposit found in modern settings and inferred ancient equivalents. We concentrate on aspects of the deposits' genesis related to the regional tectonic setting, and no attempt is made to review features such as temperature of formation or mineralogy which can be found in textbooks concerned exclusively with mineralization and ore bodies.

The authors divide tectonic settings into six categories; each category is in turn further subdivided into seven groups. The six major categories are (1) hot spots, rifts, and ophiolites; (2) passive continental margins and interior basins; (3) oceanic settings (ridges, basins, transforms, and hot spots); (4) subduction-related settings; (5) collision-related settings; and (6) transform faults and lineaments in continental crust.

The authors conclude by tracing the evolution of mineral deposits through an orogenic cycle and then devote a five-page chapter to tectonic settings as a guide to exploration. The book has an abundance of figures reprinted from the literature and 36 pages of references (published by 1981) that are invaluable, especially because readers interested in plate tectonics are not generally familiar with the literature of ore deposits.

The authors are both ambitious and courageous in attempting to synthesize knowledge of this subject, and their attempt is an unqualified success. Summaries of examples of deposits in different tectonic settings are left with many unanswered questions that provoked considerable thought—a sign of a good scientific book. Why are certain elements concentrated in certain settings, and why are apparently similar deposits from different settings really similar? Answers to these and other questions will appear in time and will make ore deposits a more powerful tool for tectonic interpretation.

Mitchell and Garson avoid tectonic interpretation of Archean ore deposits. As tectonic interpretation of ore deposits becomes more sophisticated, Archean ore deposits may become a useful tool for interpretation of Archean tectonism. Therefore this book is especially recommended to students of the Archean.

The authors have kept an open mind; most interpretations from the literature are presented without question. As a result, many readers will question some of the work summarized in many sections of the book. The authors' philosophy was clearly to offer completeness rather than to present their own favorite interpretations. An example is their reporting a theory for the origin of fluorite deposits in western North America that alleged that the deposits were formed along a more or less continuous system of rifts and lineaments from Mexico to Alaska by fluorine from the lower crust or upper mantle. Other theories are also presented without question, yet the authors do question the widely accepted impact origin of Sudbury, Ontario.

You may not find your favorite ore deposit mentioned because of space limitations, but Mitchell and Garson did a fine job with the space available. Southeast Asian deposits receive special attention because of the authors' own experience, so the book has the additional advantage of providing an entry to the literature of these deposits not well known to Western Hemisphere readers.

Traditionally, scientific reviewers comment on typographical errors to prove that they read the book thoroughly. I found none, one reference out of place was the only mistake I could find.

I recommend this well-written book to students of both plate tectonics and ore deposits.

Although it is expensive, undergraduates and researchers alike will benefit from it.

Already the book is a little out of date. For example, since it was written, reports have appeared on the Guyana Basin sulfides and the recent Kuroko study, both with their important tectonic implications. That is not the authors' fault, but rather the sign of a burgeoning field.

Robin Brett is with the U.S. Geological Survey, Reston, VA 22092.

## AGU New Books

*Plate Reconstruction From Paleozoic Paleomagnetism*  
*Geodynamics Series*, vol. 12, edited by R. Van der Voo, C. R. Scotese, and N. Bonhommet, AGU, Washington, D.C., viii + 136 pp., black-and-white illustrations, 1984, ISBN 0-87590-512-9, AGU members \$14, others \$20.

The decade of the 1970's saw increasing global evidence leading to the reconstruction of the continents and oceanic plates through time, fostered by the Geodynamics Project. Aspects of this project are being continued under the auspices of the International Lithosphere Program; in particular, Working Group 2 of the program (Paleozoic plate motions and orogenesis) is active in the unraveling of past continental distributions and the plate tectonic products of continental motions. Paleomagnetic techniques are especially useful for the determination of continental reconstructions, and this volume presents a number of papers dealing with syntheses and new interpretations of previous results as well as new results for Paleozoic time.

The editors believe that the contents of this volume represent a state-of-the-art account of Paleozoic paleomagnetic studies as they are being carried out today. In this collection of papers the paleomagnetic successes and failures of modern paleomagnetic research are represented in accounts of remagnetizations or the lack thereof, as well as some examples where the evidence is not yet clear. All authors have emphasized the geodynamic implications of their results, as well as continental reconstructions based on the latest evidence. Geographically, the papers are representative of the Atlantic-bordering continents, albeit with a heavy emphasis on North American paleomagnetic work.

This volume is based on selected papers presented in a special symposium sponsored by Working Group 2 and the American Geophysical Union and held in Philadelphia during the 1982 Spring Meeting of the American Geophysical Union.

With this first interim report, Working Group 2 is starting a decade of international collaboration aimed at enhancing our knowledge about Phanerozoic plate motions, continental configurations, and mountain-building episodes. Future reports are planned on such topics as the structure of the Hercynian and Appalachian mountain belts, the circum-Pacific orogenic belts and the evolution of the Pacific Ocean, and the evolution of the Mediterranean and the Tethys-bordering continents, each based on symposia organized by the Working Group.

(From the preface by R. Van der Voo.)

## Contents

Foreword R. A. Price  
 Preface R. Van der Voo

## Forum

## Fall Meeting Site

The world is clearly a very troubled place. Many problems contributing to this trouble, such as climatic changes, effects of global war, geophysical disasters, etc., are the concern and come under the purview of members of AGU. Within this context, it was clear at the last AGU Fall Meeting that the matter uppermost in most members' minds was the large number of parallel sessions.

In light of the overwhelming importance ascribed to this issue, I have devoted considerable thought as to how to solve this overcrowding. Putting aside for the moment the issue of whether or not the recent Cathedral Hill Hotel fire was a sign from on high in this matter, I wish to pursue what we, as a Union, can do to solve the problem. Remarkably enough, the Meetings Committee had already apparently perceived the nature of the solution (although dimly) and had stumbled upon a form of my result in a different context. It is perhaps worthwhile for me to review this previous situation prior to presenting my ideas for the West Coast meeting.

The annual Spring Meeting used to have an alarmingly large growth rate, just as the Fall Meeting has now. Everyone seemed to enjoy going to Washington, the meeting typically occupied 5 of the 10 nice days of weather available each year in the Washington area, and the seafood (barring Red Tide) was rather good. Result: The Spring Meeting grew by leaps and bounds, sessions were overcrowded, time allocations for presentations shrank, and, eventually, the dreaded parallel session became the order of the day.

At this point the meetings committee's mind came into play. Possibly more by luck than anything else they fathomedly concluded that the meeting site should be moved. And—behold!—the growth rate of the Spring Meeting became manageable. Without there ever being a clear communication of their underlying principle, the Committee has moved nonetheless even further toward the ultimate solution (and further from the East Coast) by holding the next Spring Meeting in Cincinnati.

What does all this mean? What has this to do with the Fall Meeting? Well, of course, the above facts suggest a solution which has everything. It is simple, elegant, draconian. People like San Francisco as a meeting place, so my proposal is: let us move the meeting site. For the more timid and take-it-easy among us I might suggest that the Meetings Committee consider what I like to call "Baltimore West," i.e., Bakersfield. (My recommendation of this site has nothing—I repeat, nothing—to do with my name being similar to that of the city's founder.) If the Meetings Committee really wants to bite the bullet on this thing then I suggest that the West Coast Meeting be moved immediately to Barstow or, my favorite, Needles. I can assure you that by following this plan, the problem of parallel sessions will be reduced rapidly to a point of zero measure.

D. N. Baker  
 Los Alamos National Laboratory  
 Los Alamos, NM 87545

An Introduction to This Volume: Paleozoic Paleomagnetism and the Assembly of Pangea  
 C. R. Scotese

A Paleomagnetic Reevaluation of Pangea Reconstructions  
 R. Van der Voo, J. Peinado, and C. R. Scotese

The Tethys Paradox in Plate Tectonics  
 J. Stocklin

On the Tectonic Evolution of Mexico: Paleomagnetic Constraints  
 J. Urrutia-Fucugauchi

Paleomagnetism of the Middle Mississippian Greenbrier Group in West Virginia, USA  
 D.-S. L. Chen and V. A. Schmidt

Paleomagnetic Results From the Carboniferous of Nova Scotia  
 C. R. Scotese, R. Van der Voo, R. E. Johnson, and P. S. Giles

Late Paleozoic Motions of the Meguma Terrane, Nova Scotia: New Paleomagnetic Evidence  
 D. J. Sparrow, D. V. Kent, and J. D. Kippie

Paleomagnetism of Lower-Middle Devonian and Upper Proterozoic-Cambrian(?) Rocks From Mejeria (Mauritania, West Africa)  
 D. V. Kent, O. Dia, and J. M. A. Sougi

Mid-Ordovician Paleomagnetism and the Proto-Atlantic Ocean in Ireland  
 E. R. Druech

Paleomagnetism of the Cambrian Rocks of the Great Valley of East Central Pennsylvania: Fold Test Constraints on the Age of Magnetization  
 R. J. Stead and K. P. Kodum

Was Laurentia Part of an Eocambrian Supercontinent?  
 R. Van der Voo, G. McCabe, and C. R. Scotese

## Classified

## Announcement

New rates for classified advertising effective January 1, 1984:

## RATES PER LINE

**Positions Available, Services, Supplies, Courses, and Announcements:** first insertion \$5.00, additional insertions \$4.25.  
**Position Wanted:** first insertion \$2.00, additional insertions \$1.50.  
**Student Opportunities:** first insertion free, additional insertions \$2.00.

There are no discounts or commissions on classified ads. Any type style that is not publisher's choice is charged at general advertising rates. Eos is published weekly on Tuesday. Ads must be received in writing by Monday, 1 week prior to the date of publication.

Replies to ads with box numbers should be addressed to Box 4, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC 20009.

For more information, call 202-462-6903 or toll-free 800-424-2488.

## POSITIONS AVAILABLE

**University of Arizona/Research Associate.** Applications are invited for two possible positions as research associate in theoretical plasma astrophysics, solar physics and/or cosmic-ray astrophysics.

The successful applicant for the first of the positions will be expected to devote a substantial part of his or her research to problems in solar or interplanetary physics. This position can be filled as early as Spring 1984 and applications should be received by April 30.

The second position involves research on cosmic rays and their interactions in the solar wind or elsewhere. This position can be filled in Fall 1984, and applications should be received by July 31, 1984. Applicants for either position should possess a Ph.D. in a relevant area of physics, astronomy, or planetary sciences.

Inquiries and applications should be addressed to Professor J. R. Jokipii or Professor E. H. Levy, Department of Planetary Sciences, University of Arizona, Tucson, AZ 85721.

Applicants should send a resume, complete bibliography, and arrange for at least three letters of recommendation from persons who are well-qualified to judge the applicant's background and potential in research.

The University of Arizona is an equal opportunity/affirmative action. Title IX, Section 504 employer.

## EOS

Transactions, American Geophysical Union

The Weekly Newspaper of Geophysics

For speediest treatment of contributions send three copies of the double-spaced manuscript to one of the editors named below and one copy to AGU.

**Editor-in-Chief:** A. F. Spilius, Jr., Editors: Marcel Ackerman, Mary P. Anderson, Peter M. Bell (News), Bruce Doe, C. Stewart Gillmore (History), Clyde C. Guad, Arnold L. Gordon, Louis J. Lanzerotti, Robert A. Pinnney, Managing Editor: Gregg Force; News Writers: Barbara L. Richmond; News Assistant: Tony Belkovich; Production Staff: James M. Hebl, Lisa Lichtenstein, Cynthia T. McManigal.

For advertising information, contact Robin E. Little, advertising coordinator, at 202-462-6903 or toll-free at 800-424-2488. Advertising must be information and consistent with the scientific and educational goals of AGU and is subject to approval by AGU. Advertisers and their agents assume liability for all content of their advertisements and for any claims arising therefrom against the publisher. Offers in advertisements are subject to all laws and are void where prohibited.

Copyright 1984 by the American Geophysical Union. Material in this issue may be photocopied by individual scientists for research or classroom use. Permission is also granted to use short quotes and figures and tables for publication in scientific books and journals. For permission for any other uses, contact the AGU Publications Office.

Views expressed in this publication do not necessarily reflect official positions of the American Geophysical Union unless expressly stated.

Subscription price to members is included in annual dues (\$20 per year). Information on institutional subscriptions is available on request. Second-class postage paid at Washington, D. C., and at additional mailing offices. *Eos, Transactions, American Geophysical Union* (ISSN 0096-3941) is published weekly by

American Geophysical Union  
 2000 Florida Avenue, N.W.  
 Washington, DC 20009

**Cover.** Suggested continent positions in Eocambrian (Vendian-Tommotian) and Late Carboniferous (Westphalian-Steffanian) depicting the assembly of Pangea by the end of the Paleozoic. Shown are figures 1 and 9 from C. R. Scotese's introduction to *Plate Reconstruction From Paleozoic Paleomagnetism*, edited by R. Van der Voo, C. R. Scotese, and N. Bonhommet, the latest volume in AGU's *Geodynamics Series*, described on p. 98, and 103.

**University of Kentucky.** The Department of Geology invites applications for two tenure-track faculty positions. Areas of specialization are: 1) Geophysics, 2) Mineral or Tectonic geology with some emphasis on geochronology, geophysics, geomorphology, or petrology. It is anticipated that both positions will be filled at the level of Assistant Professor but applications for a more senior person will be considered. Degree of Ph.D. is required.

The Department awards B.S., M.S., and Ph.D. degrees. The starting rank and salary depends on qualifications and experience—either industrial or academic.

Letters of application should include a full curriculum vitae statement of intent regarding research, names of three referees, and should be addressed to: Dr. Nicholas Rast, Chairman of Search Committee, Bowman Hall, Room 275, University of Kentucky, Lexington, KY 40506-0106, 0809-275-0222.

DEADLINE for application is APRIL 15, 1984.

The University of Kentucky is an affirmative action and equal opportunity institution.

**Research Position in Space Plasma and Auroral Physics.** Two research positions at the level of assistant or associate research scientist are available in the Department of Physics & Astronomy at the University of Iowa for qualified candidates with a Ph.D. degree and experience in space plasma and/or auroral physics. Present research in space plasma physics emphasizes analysis and interpretation of observations of magnetospheric plasmas using instrumentation on board earth-orbiting spacecraft in the IMP and ISEE Missions. The University of Iowa has global imaging instrumentation on the spacecraft Dynamics Explorer I (the source of an extensive data base of auroral images from high altitudes at visible and ultraviolet wavelengths). Photometric observations are also available for other areas of research including the physics of the upper atmosphere and the global distribution of atmospheric ozone. The applicant should identify and describe areas of his or her expertise which can support existing theoretical investigations in space plasma physics and/or auroral physics. Salary and position will be determined by the applicant's qualifications and experience.

A resume and the names of three persons knowledgeable of applicant's experience should be forwarded to: L. A. Frank, Department of Physics & Astronomy, University of Iowa, Van Allen Hall, Iowa City, Iowa 52242.

The University of Iowa is an affirmative action/ equal opportunity employer.

**Oregon Turbulence/Oregon State University.** Join us studying turbulence in equatorial plasmas. A postdoctoral position is available at Oregon State University in a project entitled "Turbulent Transport in a Turbulent HEAT." The successful applicant will assume a major share of the responsibility for development of several advanced computer programs, instruments on the first TROPIC (HI 41) cruise in November 1984 and then will share responsibility for scientific analysis of the data obtained. The salary is negotiable. I August 1984, but is somewhat negotiable. Starting salary is \$20,000 yearly. Applicants must have a Ph.D. in the physical sciences of engineering and must be capable of performing independent research on a continuing basis. Applications must be received by 31 March 1984 to:

Douglas R. Caldwell  
 College of Oceanography  
 Oregon State University  
 Corvallis, OR 97331

Oregon State University is an affirmative action/ equal opportunity employer and complies with section 501 of the Rehabilitation Act of 1973.

**Air Force Geophysics Laboratory/Geophysics Scholar Program (1984-1985).** The Air Force Geophysics Laboratory (AFGL) and The Southeastern Center for Electrical Engineering Education (SCEEE) announce that applications are invited for research appointments during the 1984-1985 year in the Geophysics Scholar Program. This program provides research opportunities of 10 to 12 months duration for selected Engineers and Scientists to perform research in residence at the AFGL, Hanscom AFB, near Boston, Massachusetts. Scholars will be selected primarily from such fields as Geophysics, Atmospheric Physics, Meteorology, Ion Chemistry, Applied Science, Mathematical Modeling using Computers, and Engineering.

To be eligible, candidates must have a Ph.D. or equivalent experience in an appropriate technical field. Some appointments may be confined prior to August 1984 so early applications are encouraged. All qualified applicants will receive consideration without regard to race, color, religion, sex, or national origin. Application Deadline for September Appointments: August 1, 1984. For further information and application forms contact SCEEE, 101 Massachusetts Avenue, St. Cloud, FL 32789 Telephone: (905) 892-6146.

SCEEE supports Equal Opportunity/Affirmative Action.

**Marine Geology and Geophysics/University of Washington.** The School of Oceanography is seeking candidates for a position as Research Assistant Professor, but applications at a more senior level will be considered. Preference will be given to a candidate who has research interests in marine geology and geophysics and who will interact with our ongoing research projects, especially in the area of edge-crest processes. Although this position will eventually be funded through self-generated research grants, partial financial support is available for the first two years. Teaching requirements will be limited and at the graduate level. For consideration, send a resume, a brief letter describing research interests, and four letters of reference by 1 May 1984 to:

Professor Brian T. Lewis  
 Director  
 School of Oceanography, WB-10  
 University of Washington  
 Seattle, WA 98195

The University of Washington is an affirmative action/equal opportunity employer.

**University of Rochester/Postdoctoral Position in Low Temperature Geochemistry.** The Department of Geological Sciences has a postdoctoral position for research on low-level naturally occurring radionuclides (Be-10, Cl-36, I-129, etc.). The research involves the separation of trace amounts of these elements with emphasis on the measurement of Be-10 and I-129 in a variety of materials to evaluate its potential as a tracer for fluid movement. Measurements will be carried out on the University's tandem accelerator.

The position is available immediately and is initially for one year with a possible one year extension. Send applications with resume and addresses of three referees to:

Dr. Udo Fehn  
 Department of Geological Sciences  
 University of Rochester  
 Rochester, NY 14627

The University of Rochester is an equal opportunity/affirmative action employer.

## FACULTY POSITION

**Geological Engineering Program**  
**Department of Civil and Environmental Engineering**  
**Washington State University**

The Geological Engineering Program at Washington State University has a tenure-track faculty position at the assistant/associate professor level in the area(s) of geohydrology and/or borehole geophysics. A Ph.D. is required and the ideal candidate will have a background combining both areas.

**Geohydrology:** A strong background in the geological sciences and a high level of proficiency in numerical modeling is highly desirable. Geophysical exploration background is also desirable.

**Geophysics:** A strong background in borehole geophysics with interest in geohydrology and evaluation of geotechnical properties of rock is highly desirable.

The successful applicant will teach undergraduate and graduate level courses in geohydrology and/or geophysics and be expected to take over an established research program involving graduate students. Professional registration, or qualifications to obtain such registration, is desirable.

Qualified applicants should send a resume, copies of undergraduate and graduate transcripts, and at least three letters of recommendation to Dr. Surinder K. Bhagat, Chairperson, Department of Civil and Environmental Engineering, Washington State University, Pullman, Washington 99164-2010 by April 7, 1984. Washington State University is an equal opportunity/affirmative action employer.

**Staff Opportunity/Geophysical Laboratory/Carnegie Institution of Washington.** Privately endowed, basic-research and educational organization seeks outstanding scientists with broad interest in developing the principles of Element Concentration. Applicants should have a Ph.D. and at least 5 years of experimental experience involving a wide range of pressures and temperatures, theory of mass and heat transport, and field aspects of ore deposits. Familiarity with subduction research is desirable. Creative and innovative qualities essential.

Successful applicant will be appointed Earth Sciences Research Scholar for a period not to exceed three years. After demonstration of leadership and excellence in research, the Scholar will be eligible for a regular staff position. Modest funds are available for technical support of the Scholar's work.

Applications may be accepted by the Director, Geophysical Laboratory, 2801 Upton Street, N.W., Washington, D.C. 20008. Submit 3-5 page summary of proposed research program, curriculum vitae, three letters of recommendation from persons chosen by applicant, and completed Application Form obtainable from Executive Secretary. Starting date is after 1 July 1984 and is negotiable.

The Carnegie Institution of Washington is an equal opportunity and affirmative action employer.

**Faculty Position in Meteorology.** Applications are invited for a tenure-track in tenure faculty position in the Division of Meteorology and Physics in Oceanography in the Rosenstiel School of Marine and Atmospheric Science of the University of Miami. The rank and salary will be negotiated dependent upon qualifications. The applicant must hold a Ph.D. in atmospheric science, or closely related field, and have a thorough knowledge of large-scale atmospheric dynamics. We are especially seeking applicants from those interested in climate dynamics, including observational studies of all aspects of the general circulation and its interannual variability, although qualified candidates in other areas are also encouraged to apply. The successful candidate will be free to pursue an active research program with a limited amount of graduate-level teaching. Applicants should submit curriculum vitae and the names of three referees to: Dr. Eric J. Pritchard, Chairman of Search Committee, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149.

The University of Miami is a private, independent, international university and is an Equal Opportunity/Affirmative Action Employer.

**Senior Applications Chemist.** Kevex Corporation is seeking an individual with a strong Analytical Chemistry background, in particular in X-ray Fluorescence, for Applications in the Laboratory. Three years of experience in Laboratory Industrial Analytical Problem Solving using XRF is required. Advanced degree in Physical Science or Engineering is preferred. Position requires Application support in Marketing, Sales and R&D operations. Submit resume to: Mr. Drew Isaacs, Kevex Corporation, 1101 Chess Drive, Foster City, CA 94404. EOE M/F/H/V.

SENIOR SCIENTISTS  
ATMOSPHERIC SCIENCE  
METEOROLOGISTNASA-Goddard Space Flight Center  
Laboratory for Atmospheric Sciences  
Greenbelt, Maryland 20771

NASA/Goddard Space Flight Center, Laboratory for Atmospheric Sciences is now accepting applications for two senior scientist positions to lead scientific research in global weather and climate modeling, predictability studies and related research in the Global Modeling and Simulation Branch. Development and maintenance of collaborative activities with the academic community and other institutions/agencies are also important.

The research program strongly emphasizes use of remotely sensed data in numerical weather prediction, and cooperative efforts with other branches of the Laboratory engaged in atmospheric and climate research. The objectives of research in this branch are to investigate the dynamics of global scale processes including climate and boundary processes on various space and time scales. Activities include theoretical and descriptive studies, modeling and prediction of the atmosphere, data set preparation, future observing system simulation studies, algorithm development and research aimed toward design of new or improved satellite missions. The Branch also has responsibility for leading an "Experimental Climate Forecast Center" recently established under an arrangement with the National Climate Program Office. Providing leadership for this new activity would be a part of the role of one of these two senior positions. There is at present a staff of ten research personnel headed by Dr. Eugenia Kalnay, in addition to a substantial support staff.

These positions will be at the GS-14-15 level with a salary range between \$42,722 and \$63,327, the present salary ceiling.

Interested applicants should send resumes no later than May 30, 1984 to:

Dr. D. Atlas, Chief  
 Laboratory for Atmospheric Sciences  
 NASA/Goddard Space Flight Center  
 Code 910  
 Greenbelt, MD 20771.



## DEPUTY EXTERNAL RESEARCH

The U.S. Geological Survey (USGS), Geologic Division, Office of Earthquakes, Volcanoes, and Engineering (OEVE) announces a vacancy for Deputy for External Research to act as a senior staff member and consultant to the Chief, OEVE. In planning of contract and grants programs relating to earthquake hazards reduction research. Duties include managing, reviewing, and coordinating contracts and grants in earthquake research undertaken by OEVE, and maintaining contact with both public and private institutions and agencies conducting related research. Geographic location of this position (Reston, Virginia; Denver, Colorado; Menlo Park, California) is subject to negotiation, depending upon selectee's preference and the requirements of management. Position is a GS-15 with initial salary of \$50,252 per annum for new Federal employees. Send Standard form 171 (SF-171), Personal Qualifications Statement, available at any Federal Personnel Office, to:

Geological Survey  
ATTN: Mr. R. W. Mervine  
215 National Center  
Reston, Virginia 22092

A detailed resume of education, experience, and salary history may be substituted if an SF-171 is not available. All applicants must submit copies of college transcripts or a list of courses taken. Applications must be received in the USGS Personnel Office by April 13, 1984.

Equal Opportunity Employer.

**Staff Position/Department of Terrestrial Magnetism.** The Department of Terrestrial Magnetism of the Carnegie Institution of Washington invites applications for a staff position in geophysics. Applicants should have a demonstrated ability for active and innovative independent research using magnetic and/or isotopic techniques to investigate the origin and geological evolution of the solid earth.

Applicants should send a resume and have three letters of reference forwarded by May 15 to: Geophysics Staffing Committee, Department of Terrestrial Magnetism, 5211 Broad Branch Road, N.W., Washington, D.C. 20015.

Starting time for the appointment is flexible through a target date of late 1984 is preferred. Carnegie Institution of Washington is an equal opportunity, affirmative action employer.

**Faculty Position/University of Montana.** The Geology Department of the University of Montana is inviting applications to fill a temporary, one-year position at the Assistant Professor level (contract period will be from September 1984 to early June 1985). This position involves teaching of a land use and/or environmental geology course. A Ph.D. in geology is preferred, however, M.A.'s with teaching or professional experience will be considered. Students planning to complete their doctorate during the 1984-85 academic year are encouraged to apply. Teaching responsibilities include undergraduate courses and introduction to geology, mineralogy, petrology, sedimentology, and a seminar in area of special interest.

Those interested should send a letter of application, resume, three letters of recommendation to: Arnold J. Silverman, Chairman, Department of Geology, University of Montana, Missoula, MT 59812. The DEADLINE for applications is May 15, 1984. The University of Montana is an affirmative action/equal opportunity employer.

## POSTDOCTORAL APPOINTMENT IN ANALYTICAL, SEPARATION OR RADIOCHEMISTRY

The Isotope Geochemistry group of the Los Alamos National Laboratory is seeking candidates for a postdoctoral appointment in analytical, separation or radiochemistry.

This opportunity will include participation in a solar neutrino experiment [Science 216, 51 (1982)] with involvement in separation and purification of trace quantities of technetium from large quantities of molybdenum. Experience in wet chemical separation is required.

The Laboratory, one of the nation's foremost scientific research organizations, is operated by the University of California for the U.S. Department of Energy. Our location in the mountains of northern New Mexico offers an unexcelled lifestyle with ample recreational activities.

Our postdoctoral appointments are for one year, renewable for a second year and pay a stipend amount of \$26,200 to \$27,600 per annum. We provide employee benefits, including incoming travel and moving expenses. Candidates no more than three years past their Ph.D. are invited to apply. U.S. Citizenship is required.

Send your resume in confidence to:

Madeline Lucas, DIV 84-AT  
Personnel Services Division  
Los Alamos National Laboratory  
Los Alamos, New Mexico 87545



**Coastal Dynamist at Stony Brook.** Position with tenure at advanced Associate Professor or Assistant Professor level to be available mid-June 1984, for a physical oceanographer specializing in coastal ocean dynamics, with a strong interest in analytical and numerical modeling. Must have demonstrated ability to attract research support. Position carries full support for the academic year. Candidates should send resume and the names of three individuals from whom letters of reference may be obtained, to Dr. Donald W. Pritchard, Associate Director for Research, Marine Sciences Research Center, SUNY Stony Brook, Stony Brook, NY 11794. Deadline for applications is May 1, 1984. SUNY Stony Brook is an equal opportunity/affirmative action employer. AKF 87-81B.

**The University of Texas at Dallas/Postdoctoral Openings.** The University of Texas at Dallas occasionally has postdoctoral openings in the Geology Program. Current research areas include: XUV Lasers and Laser Spectroscopy (C. B. Collins and C. D. Cantrell); Space Plasma Physics (W. B. Hanson and W. J. Heikkinen); Space Optics (B. A. Finley, University of Texas at Dallas); Solid State Physics (R. Glaser and R. Chao); Synchrotron radiation. Interested applicants should send a curriculum vitae, resume and names of three references to: Dr. David Schwartzman, Department of Geology/Geophysics, Howard University, Washington, DC 20059.

**Howard University/Graduate Faculty Position.** The Department of Geology/Geophysics invites applications for a tenure track position in geochemistry at rank of Graduate Associate Professor beginning August 1984. Position involves development of graduate research program at Master's level. Specialization in environmental geochemistry/geochemistry/geochemistry desired. Send letter of application, resume and names of three references to: Dr. David Schwartzman, Department of Geology/Geophysics, Howard University, Washington, DC 20059.

**Sedimentologist.** The Geology Department at Washington State University announces an Assistant Professor tenure track position for a field-oriented classic sedimentologist, commencing August 16, 1984. Applicants will be expected to:

1. carry on an active research program
2. supervise graduate students at the M.S. and Ph.D. levels
3. teach undergraduate courses and graduate courses in their specialty.

The Geology Department at WSU is a young, growing department housed in a modern building with research facilities including a micropore, SEM, sedimentology lab, etc. There are currently 12 faculty members, 50 undergraduate majors and 60 graduate students. In addition the Department shares a Geological Engineering program with Civil and Environmental Engineering.

Closing date for application is May 17, 1984. Candidates must have the Ph.D. and should have a resume, transcripts and list of five references sent to: G.D. Webster, Chairman, Department of Geology, Washington State University, Pullman, WA 99164-2812.

Washington State University is an equal opportunity/affirmative action employer.

**Planetary Geologist/Geophysicist Jet Propulsion Laboratory, Earth & Space Sciences Division.** The Planetary and Oceanographic Section anticipates the availability of one or two full-time, staff scientist research positions in the areas of planetary geology and geophysics. The rank of appointment is open, but applicants should be beyond the postdoctoral level with a demonstrated record of expertise and accomplishments in independent research and publication. We welcome applicants with interest in structural geology and geophysics as applied to the study of solid-body planets and natural satellites with emphasis on determining surface properties and processes on planetary objects using ground-based and spacecraft remote sensing data and applicable theoretical and experimental techniques. Applicants should send letter outlining their experience, professional goals, resume, and copies of pertinent publications to: Dr. William R. Ward, Manager, Planetary and Oceanographic Section, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Dept. 131, Mail Stop 240-101, Pasadena, CA 91109. An equal opportunity employer.

**Physician.** The National Oceanic and Atmospheric Administration (NOAA) announces a Physician, GS-15, vacancy in the Environmental Research Laboratories, Space Environment Laboratory, Supporting Research Division, Boulder, Colorado. Starting salary at GS-15 level is \$36,132. Duties include conducting research on the physics of the solar corona as related to the emission of matter and radiation which result in disturbances in the near-earth environment. Demonstrated achievement in basic environmental research is required. For further information and application procedures, please call Mary Plummer, NOAA Personnel at (303) 497-3102. Applications must be received by March 30, 1984, to be considered.

An equal opportunity employer.

**Faculty Position at Scripps Institution of Oceanography/Institute of Geophysics and Planetary Physics.** Applications are invited for a tenure track faculty position in the broad field of fluid dynamics which includes, for example, oceanography, both theoretical and observational, numerical modeling of fluids, and the dynamics of the earth's core. This appointment is the case for all other faculty appointments at IGPP, will be made jointly with the teaching department of Scripps or another department at the University of California, San Diego. Qualifications include a Ph.D. in one of the sciences (original research), demonstrated competence in original research (presumably through publication in refereed journals), and in teaching at both the undergraduate and graduate level, with the ability to direct an appropriate command of both spoken and written English. Qualified applicants at all levels will be considered. Salary will be commensurate with the individual's qualifications. Please send applications and nominations to:

Professor Freeman Gilbert  
University of California, San Diego  
Institute of Geophysics and Planetary Physics  
La Jolla, CA 92093  
Responses must be received by April 20, 1984. The University of California is an affirmative action/equal opportunity employer.

**Research scientist/University of Colorado.** The Laboratory for Atmospheric and Space Physics at the University of Colorado seeks qualified research scientists in the field of atmospheric physics. The successful applicant would conduct research with the scientific team at LASP analyzing more than two years of Solar Mesospheric Explorer (SME) data. The extensive data base includes global measurements of ozone, temperature, water vapor, and other parameters of the Earth's Mesosphere and Stratosphere. A doctorate or its equivalent in a relevant subject is necessary. The person(s) selected must be capable of conducting independent research and working as part of a scientific team. A background in solar, planetary or atmospheric sciences is desirable. Salary commensurate with experience. Applications including a current professional resume and names of three references should be sent to:

Dr. R.J. Thomas  
Laboratory for Atmospheric and Space Physics  
Campus Box 392  
University of Colorado  
Boulder, Colorado 80309.  
Applications are being accepted on a continuous basis.

The University of Colorado is an equal opportunity/affirmative action employer.

**University of New Mexico/Paleomagnetism.** The Department of Geology of the University of New Mexico invites applications for a tenure track full-time position as an Assistant Professor with a specialty in paleomagnetism beginning Fall 1984. The successful candidate will be expected to maintain an active research program and teach at the undergraduate and graduate level. The Department has six full-time faculty, is located in a spectacular natural setting and has excellent analytical facilities. Applicants should submit a resume, transcripts, and three letters of reference to: R. Ewing, Department of Geology, Albuquerque, New Mexico 87131. The deadline for applications is April 10, 1984.

The University of New Mexico is an equal opportunity/affirmative action institution.

## The Lunar and Planetary Institute announces publication of a new book entitled CHONDRULES and their ORIGINS

edited by E. A. King, Jr.

• Contains 25 review papers and original research contributions designed to provide the reader with a broad overview of the most recent data and knowledge regarding the origin and history of chondrules.

• 375 pages with 120 figures, 29 tables, a thorough subject index, and an extended bibliography of 467 related papers.

• Price is \$33.00 (including shipping and handling). Books shipped to foreign destinations will be sent via surface mail unless \$15.00 for each book ordered is added to cover airmail postage costs.

Available in hardcover only ISBN 0-942852-01-5

To order, send check, money order (drawn on U.S. banks only), or completed purchase order for \$33.00 to:

Code C  
Lunar and Planetary Institute  
3303 NASA Road One  
Houston, TX 77058

**New Mexico Institute of Mining & Technology.** New Mexico Institute of Mining & Technology has a vacancy for a permanent full-time research physicist. Work locations would be Workman Center on New Mexico Tech's campus and on top of South Bald near Langmuir Laboratory in the Magdalena Mountains of Central New Mexico, 17 miles southwest of Socorro. Duties will include the operation and maintenance of lightning measuring instruments in two KIVAS; experiments causing lightning channels to connect to sensors mounted above KIVAS; reduction of data and preparation of reports and scientific papers on results of research at the KIVAS; contract administration, proposal writing and negotiating with agencies sponsoring research at the KIVAS; teaching, as appropriate, of academic classes in the College Division. The successful candidate should have a Ph.D. or equivalent in physics or electrical engineering. Candidate needs to be competent in use of electronic and digital measuring equipment and of computer-aided data analysis. Should have several years of professional work experience and be scientifically motivated. Send applications to: New Mexico Tech, Personnel Office, Brown Hall, Socorro, NM 87801. An equal opportunity/affirmative action employer.

## POSITIONS WANTED

**Seismologist.** Ph.D. early 1981 seeking research or teaching position. Experience includes reflection seismology on geophysics, reflection modeling, crustal studies in continental deformation, microearthquake surveys, intimate knowledge of computers including VAX-IBM VMS and CPM of microcomputer. Box 920, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20005.

## STUDENT OPPORTUNITIES

**Research Assistantships/University of Maryland.** The Meteorology Department of the University of Maryland has research assistantships available for graduate students, Fall Semester 1984. The Department offers courses of study leading to the degrees of Master of Science and Doctor of Philosophy in meteorology. Students with a bachelor's degree in meteorology, the physical sciences, mathematics, or engineering are invited to apply.

Situated in the Maryland suburbs of Washington, D.C., the University is in an ideal location for interdisciplinary research in the meteorological community of the area. The Department has cooperative research agreements with the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration. Access to facilities of

these and other government agencies, including the large computers at the National Center for Atmospheric Research and NASA, are important resources for students at Maryland. The Cooperative Institute for Climate Research and the Center for Ocean-Land-Atmosphere Interactions, both established recently on campus, offer the student excellent opportunities for advanced study and research in climate analysis, modeling and prediction. A large number of private and government agencies within the metropolitan Washington, D.C. area offer employment opportunities.

Interested individuals are encouraged to write for more information to the following address: Chairman, Department of Meteorology, University of Maryland, College Park, MD 20742.

Research Fellowships at the University of Notre Dame. Fellowships in groundwater physics, groundwater chemistry, anaerobic processes and bioengineering are currently available in the Environmental Engineering Program of the Civil Engineering Department. Successful applicants will be awarded annual stipends of up to \$10,000, plus full tuition. For additional information, contact Dr. Aaron A. Jennings, Department of Civil Engineering, University of Notre Dame, Notre Dame, IN 46556 (219-239-5846).

Unesco, described the importance of historical seismic data and the Unesco interests in having these data available for the analysis of seismic risks, particularly in areas where the recurrence rate of significant earthquakes is very low and for regions where much data do

AGU (cont. on p. 102)

## AGU

### AGU Scholars

In recognition of the strong support of the American Geophysical Union and its substantial contribution to the American Geological Institute's (AGI) Minority Participation Program, 12 of the 1983-1984 AGI scholarship participants were designated "AGU Scholars." Because part of this support comes from a matching grant from the National Oceanic and Atmospheric Administration to increase the number of minority students studying in fields related to the development of marine and coastal resources, five of these students were designated "AGU Sea Scholars."

The AGU Scholars, all of whom have elected courses of study related to the broad areas of interest of the Union, are Rufus Catchings, a geophysics graduate student at Stanford University; Charles R. Elerson, a graduate geophysics student at Louisiana Technical University; Ronald L. Keas and Orlando M. Marques, undergraduate geophysics students at the Colorado School of Mines; Andrew Lewis Mickle, a hydrology graduate student at the University of Florida; Jaime Rangel, an undergraduate geophysics student at the University of Texas at Austin; and Ronald Wynn Sheets, a graduate geochemistry student at Ohio State University.

The AGU Sea Scholars are Aaron Anthony Diaz, an undergraduate oceanography student at Washington State University; Adam Green, a marine sciences undergraduate student at Southampton College of Long Island University; Peter A. Herrera, a geochemistry graduate student at the Colorado School of Mines; Michael W. Howell, a marine geochemistry student at the University of Michigan; and Dawn J. Wright, an oceanography graduate student at Texas A&M University.

Catchings, Howell, and Wright have been AGU Scholars in prior years.



Aaron A. Diaz



Michael W. Howell



Andrew L. Mickle



Jaime Rangel



Dawn J. Wright

## Actions at Hamburg

International Association of Seismology and Physics of the Earth's Interior

### Historical Seismograms

The third Workshop on Historical Seismograms, held in Hamburg on August 18-19, 1983, in conjunction with the meeting of the International Union of Geodesy and Geophysics in Hamburg, Federal Republic of

## Spring Forward and invite a colleague to join AGU today.

They will then be eligible for the Member Registration Fee at the Spring Meeting.

## Spring Benefits

- The saving on your registration fee will pay your dues — only \$20 for members and \$7 for students.
- The Abstracts issue of Eos in advance of the meeting if payment is received by March 30.
- Recognition as an AGU member at the meeting — AGU members have special badges.

Send your check with the application below or charge it to your credit card.

MEMBERSHIP APPLICATION		1984		AMERICAN GEOPHYSICAL UNION 2000 FLORIDA AVENUE WASHINGTON, DC 20009	
<p><b>REGULAR MEMBERS</b>—individuals who are professionally engaged in or associated with geophysics including college or university students. Students enrolled in at least a half-time program of study leading to a degree receive special reduced dues and journal subscription rates. <b>ASSOCIATES</b>—individuals not professionally involved but with an interest in geophysics. Associates may not vote or hold office. Send applications together with payment for first year's dues and journals to AGU.</p>					
<p><b>PREFERRED MAILING ADDRESS</b></p>					
<p>Each line of boxes represents one line of address. Please abbreviate as necessary to fit within space provided. PLEASE PRINT ALL INFORMATION CLEARLY</p>					
FIRST NAMES AND/OR INITIALS			LAST NAME		
FIRST LINE OF ADDRESS					
SECOND LINE OF ADDRESS (OPTIONAL)					
CITY		STATE (USA only)		ZIP CODE (USA only)	
COUNTRY			FOREIGN POSTAL CODE		
TELEPHONE (Phone numbers provided will be published in the membership directory)					
HOME		AREA CODE		NUMBER	
OFFICE		AREA CODE		NUMBER	
		EXT		TITLE	
				<input type="checkbox"/> DR <input type="checkbox"/> PROF <input type="checkbox"/> MR <input type="checkbox"/> MS <input type="checkbox"/> OTHER - SPECIFY	
EMPLOYMENT					
EMPLOYER					
JOB TITLE					
DEPARTMENT					
LOCATION					
CITY		STATE (USA only)		ZIP CODE (USA only)	
COUNTRY			FOREIGN POSTAL CODE		
<p><b>JOB FUNCTIONS</b> Check up to 3 which best describe your area(s) of functional responsibility.</p>					
<p>A <input type="checkbox"/> CONSULTANT F <input type="checkbox"/> ENGINEERING            B <input type="checkbox"/> STUDENT G <input type="checkbox"/> ADMINISTRATIVE-R&amp;D            C <input type="checkbox"/> TEACHING H <input type="checkbox"/> ADMINISTRATIVE-NON R&amp;D            D <input type="checkbox"/> BASIC RESEARCH I <input type="checkbox"/> FIELD EXPLORATION            E <input type="checkbox"/> APPLIED RESEARCH J <input type="checkbox"/> RETIRED            M <input type="checkbox"/> OTHER - please specify         </p>					
<p><b>EMPLOYER CLASSIFICATION</b> Check the one which best identifies your employer:</p>					
<p>A <input type="checkbox"/> MILITARY ACTIVE E <input type="checkbox"/> OTHER NON-PROFIT            B <input type="checkbox"/> U.S. FEDERAL GOV'T F <input type="checkbox"/> BUSINESS OR INDUSTRY            C <input type="checkbox"/> OTHER GOVERNMENT G <input type="checkbox"/> SELF EMPLOYED            D <input type="checkbox"/> UNIVERSITY H <input type="checkbox"/> UNEMPLOYED            I <input type="checkbox"/> OTHER - please specify         </p>					
GENERAL					
DATE OF BIRTH		EDUCATION - Indicate level of highest degree earned.		INSTITUTION AT WHICH HIGHEST DEGREE EARNED	
MONTH/YEAR		<input type="checkbox"/> DOCTORATE <input type="checkbox"/> MASTERS <input type="checkbox"/> BACHELORS <input type="checkbox"/> NO COLLEGE DEGREE		YEAR HIGHEST DEGREE EARNED	
SECTION AFFILIATION					
<p>Check the sections with which you desire affiliation and indicate the single section with which you wish to be principally affiliated.</p>					
<p> <input type="checkbox"/> GEODESY (G)  <input type="checkbox"/> SEISMOLOGY (S)  <input type="checkbox"/> ATMOSPHERIC SCIENCES (M)  <input type="checkbox"/> GEOMAGNETISM AND PALEOMAGNETISM (GP)  <input type="checkbox"/> OCEANOGRAPHY (O)         </p>					
<p> <input type="checkbox"/> VOLCANOLOGY, GEOCHEMISTRY, &amp; PETROLOGY (V)  <input type="checkbox"/> HYDROLOGY (H)  <input type="checkbox"/> TECTONOPHYSICS (T)  <input type="checkbox"/> PLANETOLOGY (P)         </p>					
<p> <input type="checkbox"/> SOLAR PLANETARY RELATIONSHIPS  <input type="checkbox"/> AERONOMY (A)  <input type="checkbox"/> COSMIC RAYS (CR)  <input type="checkbox"/> MAGNETOSPHERIC PHYSICS (SM)  <input type="checkbox"/> SOLAR &amp; INTERPLANETARY PHYSICS (SI)         </p>					
<p>(Be sure to complete this or you may miss special mailings of interest to your discipline.)</p>					



